DOCUMENT RESUME

ED 221 922 EA 014 981

AUTHOR Moore, John A.
TITLE Reforming Education in America: A Critical National Need.
PUB DATE Nov 81
NOTE 80p.; Circulated by the Commission on Human Resources of the National Research Council, Washington, DC.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Academic Standards; *Curriculum Development; Educational Change; *Educational Improvement; Educational Objectives; *Educational Quality; Elementary Secondary Education; Higher Education; National Organizations; Public Policy; *Relevance (Education); School Effectiveness; Student Needs; *Teacher Education

ABSTRACT

Our educational establishment is so obviously failing the nation that the time for drastic remedial action is now. The nation needs first-rate scientists and engineers. It also requires a population that has a solid understanding of science grounded in a good general education. Our current ability to achieve these goals will not be used until national direction is provided by an agency other than federal or state government. The inadequacy of today's education results from schools' failure to demand quality from students (schools are often used to achieve society's social goals at the expense of education); from the teaching profession's inability to reward or attract capable newcomers; and from the universities' failure to train teachers to determine course content and instructional methods appropriate to the developmental levels of the students they teach. Solutions to some of these problems can be achieved through the formation of a national group to give direction to education and establish standards for textbooks, course content, teacher quality, and student performance. Further solutions involve raising standards for admission to institutions of higher education, reforming the undergraduate curriculum drastically, increasing cooperation between schools of education and other departments in their host universities, and enforcing higher standards for teachers and schools. (Author/PGD)

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REFORMING EDUCATION IN AMERICA

A CRITICAL NATIONAL NEED

by

John A. Moore

Circulated by

Commission on Human Resources
National Research Council

Washington, D.C.

November 1981

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FOREWORD

In an editorial note[1] congratulating Frank Press on his election to the presidency of the National Academy of Sciences, the editor of Nature mentioned a plethora of problems requiring the new leader's attention. Included was the need to arrest a perceived decline in education in science and engineering in the United States. The editor went on to take the National Academy and its members to task for not already leading an effort to revitalize American education:

> Hitherto, the academy's machinery for cogitating about problems of general concern has been directed towards specific contemporary problems, where data gathered by research promise to illuminate matters of general interest. The academy has been much less concerned with the machinery by which the scientific enterprise is sustained. The education of students in school and colleges? The National Science Foundation has been allowed to set the pace, at least until its budget was slashed last month... The surprise so far is that the academy seems to have had very little interest in these issues.

The problem referred to is real, but the charge that the National Academy and its related National Research Council have neglected it is unjust. Both historically and contemporaneously these organizations and their members have taken leading roles in trying to strengthen education in science and education at all levels in the United States. One need only mention the key role played in the curriculm reform movement of the 1950's and 1960's by Academy members Bentley Glass, John Moore, Glenn Seaborg, George Pimentel, James Ebert, Philip Handler, Edward Purcell, and Jerrold Zacharias — to name just a few — to realize that the Academy membership was deeply involved. In a more recent period, the National Research Council, through its Commission on Human Resources, sponsored a study that led to the highly-regarded 1979 report The State of

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[1] Nature, Vol, 290, p. 723, 30 April, 1981.

School Science.[2] The Commission has devoted a considerable amount of effort over the last four years to defining the problems of school science and organizing efforts to address them seriatim: this effort will continue.

Frank Press himself brings to the NAS presidency a strong interest and concern for improved science and engineering education. It was exemplified earlier by his action as President's Science Advisor in 1980 when he recommended to President Carter that a study of the growing problems of education in those fields be carried out by the National Science Foundation and the Department of Education. The study led to the report Science and Engineering Education for the 1980's and Beyond[3], which detailed many serious educational problems and proposed national approaches to a solution. Dr. Press can be expected to be an active leader in future efforts by the Academy, in its traditional role as advisor to government, to point up educational problems and suggest appropriate actions by the federal government and the scientific and technical communities.

The present document is yet another example of interest and concern, in this case by a member of both the National Academy of Sciences and the Commission on Human Resources. John Moore has had a long interest in science education, first as a scientist and educator himself, secondly as a participant in the extremely productive Biological Sciences Curriculum Study Committee (BSCS) of the 1960's, and always as a thoughtful citizen. As the chairman of the BSCS Committee on the Content of the Curriculum, he helped to provide the initial guidance of this influential project to upgrade the quality of biology teaching. He personally supervised the program that produced the two experimental and first three commer-

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[2] The State of School Science: A Review of the Teaching of Mathematics, Science and Social Studies in American Schools, and Recommendations for Improvements. Washington, DC: National Research Council, 1979.

[3] Science and Engineering Education for the 1980's and Beyond. Washington, DC: National Science Foundation, 1980.

cial editions of the famous "Yellow Version" textbook Biological Science: An Inquiry Into Life, that not only set a new course for biology education in secondary schools in this country, but in translated editions have been used worldwide.

The paper that follows was inspired by discussions within the last year at meetings of the Commission on Human Resources. Throughout, Dr. Moore maintained that the educational position of the United States is slipping seriously, that a vigorous effort needs to be launched to reverse the decline, and that all education -- not just school science and mathematics -- is in peril. He has organized his thoughts in this paper, which has been discussed at considerable length and with much mutual benefit by the members of the Commission. Although it remains his personal contribution and is not a "committee report", the paper conveys a sense of urgency of the problem that Commission members share. It also suggests some solutions, not all of which are endorsed by every member of the Commission, but which were deemed useful and imaginative as illustrations of the approach Dr. Moore would like to see taken. It's a thoughtful and hard-hitting statement by some one who's been there and knows what he is talking about.

In bringing Dr. Moore's paper to the attention of leaders in science and engineering, education, government, private foundations, and the public media, the Commission on Human Resources hopes that it will receive careful attention as a call to action — a clarion call, it is to be hoped -- and, if not a fully developed plan, at least a useful reconnaissance. The educational problems we face are serious, and, in Dr. Moore's words, we collectively need to show that "we mean business".

Harrison Shull
Chairman
Commission on Human Resources

September, 1981

PREMISES

The central concern of the Commission on Human Resources is, obviously, human beings. Not everything about human beings - their health, wealth, and happiness are left to others - but their effectiveness in being able to maintain and enhance the scientific and technological bases of society. A first-rate scientific and technological establishment is not a luxury. It is the sine qua non for the survival of the United States in an increasingly complex, unpredictable, overpopulated, and insecure world. Science for the sake of science must be replaced by science for the sake of the nation. And the road to science is education - education for those who will be professional scientists and, of equal importance, education for all citizens who must decide the uses to which scientific knowledge will be put and who must be supportive and protective of the scientific endeavor.

My first premise, therefore, is that the nation requires that a high proportion of its citizens has at least a modicum of knowledge of the data of science and considerable understanding of the promise and problems, and possibilities and limitations, of the procedures of science. It is preeminently important that our citizens understand the difference between opinions based on science and opinions which are not. The current public's reactions to the claims of the creationists suggests that we have a long way to go in reaching the goal of general scientific literacy.

It is essential that there be understanding, toleration, and acceptance of the two great systems of human thought - the humanistic and the scientific. Their synergistic interplay can go far to ameliorate the human condition today and will be fundamental for a better world tomorrow. Our morals, ethics, taste, aesthetics, happiness, choices, love, religion, brotherhood, and Golden Rule - in fact, all those peculiar attributes that make us human - are in the domain of the humanities. Science for most of its history served mainly to titilate

the mind - and the rare mind at that. Today it gives such understanding of the natural world and such power to manipulate that world that many regard it as a personal and societal threat. But whether it is threat or salvation depends on the humanistic choice we make. Once that humanistic choice has been made, science may serve as a powerful, and usually necessary, tool to achieve the desired goal.

In the world today, we cannot dispense with either of these great systems of human thought. A world of science without the humanities would be barbarism. A world of the humanities without science would be - - - barbarism.

My second premise is that, above this general level of scientific literacy, the United States requires a large cadre of first-rate scientists and engineers, and in addition, public officials with a deep insight into science and technology - enough insight to exert wise leadership and to allow effective administration.

My third premise is that it is vacuous to think of education solely in science as a viable unit. First-rate education in science and technology can only emerge from first-rate general education. Thus, the problem of the whole must be considered before we seek to improve the part. During the past three decades there has been a plethora of piece-meal suggestions on how to deal with the problems of education. The general conclusion to be drawn from these efforts is that society appears to be less pleased with the educational establishment today than it was a generation ago. Thus, the basic problem becomes "How do we educate and socialize the young?" not "How do we teach them science and technology? " If we can solve the broad question, the lesser question can be answered with greater assurance.

My fourth premise is that the failure of the educational system is due largely to a failure of teachers, administrators, and parents. Failure is not

due to budgets and buildings but to a pervasive inability to agree on what should be done and acceptable ways of attempting to do it. A deduction from this premise is that a flood of federal funds in itself will do little to provide satisfactory education.

My fifth premise is that there must be some overall national direction of the educational enterprise. The dominant force in education today is a laissez faire attitude, where one accepts excellence, innovation, tradition, mediocrity, and downright fraud, with equanimity, in the name of academic freedom.

My sixth premise is that we should not look to the federal government or state governments for the leadership required to revamp the educational establishment. Both types of government have a demonstrated inability for effectiveness.

My seventh premise is that the task at issue is the improvement of education and that other worthy goals, such as those seeking to make all persons equal, must be secondary. The educational system is in such disarray that we must cure it before we seek to cure, by what we do in the schools, all the ills of society.

My eighth premise is that the education and socialization of the young is a task for society, not for the educational establishment alone. What happens in the schools and colleges is essential but not sufficient. So, with the reform of the schools, there must come increasing support from the home, the community, the business world, and local government. "Support" is being used here, not as a euphemism for dollars, but to indicate a concerned and nurturing involvement. The state of education reflects the state of society and the acceptance of this fact is essential for educational reform. No amount of dollars alone can buy good education. Education is not a product; it is the most characteristic feature of human existence.

My ninth premise is that enough information is already available about the

state of our educational institutions and what remedial action is likely to succeed. We need action, not additional studies. This transition will come hard since the Chicken Little Syndrome, that leitmotiv of academics, finds it more comfortable to bewail a situation than to seek its amelioration.

My tenth, and all-inclusive premise, is that our educational establishment is so obviously failing the nation that the time for drastic remedial action is now. I do not know what the "moral equivalent of war" on ignorance might be, but we had better start to find out.

While it is essential that we recognize the wholeness of education, it is necessary for the argument that it be divided into its component parts for discussion. Thus, we can consider, seriatim, students, teachers, curriculum, educational resources, home, community, and so on. Nevertheless, even the attempt to consider the parts will emphasize the importance of the whole.

MAINLY ABOUT PROBLEMS

Reflections on the Young

The dominant concern in this area is that an unacceptably large fraction of students today simply do not measure up to what is required of them. We deplore their poor attitudes and their lack of abilities. They cannot read, write, count, or fill out a job application. Lacking inner resources they depend on the more banal programs of TV instead of the truly outstanding productions for inspiration, entertainment, guidance, and something to do. A little reflection suggests, however, that there has never been a time in human history when the adults saw great virtue, or even promise, in their young. Paleolithic papa no doubt saw his son as all thumbs (bruised) as son attempted to fashion a stone ax.

The adults' distress with the young can be expressed even while realizing that junior's behavior is molded by home and society. It would be ridiculous to maintain that the decline of the emerging generation is a consequence of the

deterioration of its genetic endowment. If we are unhappy with the product, the blame must be borne by those who seek to socialize and educate the young. The fault, dear Brutus, is not in our genes but in ourselves.

Consider, for example, one of the adult generation's attempt to Do Something. Deploring the fact that some students are being graduated from high school unable to read, write, or make change, society demanded proficiency examinations so that "a high school diploma would mean something." In some states these examinations have been pitched at the eighth grade level. This is truly an astonishing solution: students are to be certified as high school graduates for a level of achievement that they should have attained before even entering high school.

The take-home message here, for pupil and public, is whatever is achieved in grades 9-12 is nice but totally unnecessary. "Doing one's best" is superfluous. If the logic of my argument is accepted, and I believe the logic to be impeccable, a proposal of national importance can be made: in our budget cutting mood today it would be quite acceptable to demand eighth grade performance for graduating from the eighth grade; then we could abolish the high schools with a saving of untold billions of dollars each year.

This farce has exposed an even greater tragedy: large numbers of high school students are now found to be unable to pass the eighth grade proficiency examinations. This dismal result is obtained even when the local school districts are allowed to adjust the "eighth grade level" to the realities of their special situation. Adjust down, naturally. A current example of this is a bill, endorsed 16-1 by Committee, and now being considered by the California State Assembly. Proficiency tests are required for graduation but high school seniors who failed the proficiency tests will be graduated if their school districts do not provide adequate remedial education. In addition, the school districts will be required to "localize" the proficiency tests.

For example, math questions relating to checking accounts may be inappropriate since, to quote the author of the bill, "there are some students in inner cities that don't even know what a checking account is ..." Now that's a nice thought: students should not be held responsible for knowing things they do not know.

It is hard to exaggerate the consequence for human lives of the adult generation's bankruptcy in this situation - and there is no national voice to emphasize that it is vital to the nation that eighth grade students perfom at a demanding eighth grade level and that twelfth grade students perform at a demanding twelfth grade level.

If such demands were made and enforced, the majority of the young would shape up. But we adults have to shape up first.

The educational environment can do much to set the goals and the procedures for learning but, alone, it cannot produce educated individuals. Above all else, learning is a personal affair. Society can make learning possible, but in the last analysis, it is the effort devoted to learning, not the effort devoted to teaching that counts most heavily. Learning is lonely, difficult, and for the period of life when most of it occurs, a seemingly unrewarding task. It is not easy for the young to engage in a demanding and often onerous short-term commitment for what often appears to be a dubious long-term advantage.

But let us now ask what is known of the educational attainments of pre-university youth. The following are the sorts of things that are currently being carried by the mass media and so shape the public's perception of the state of education.

- The Great Society programs, and some that came later, were targeted at education for poor and underpriviledged. "Now, 16 years later, an enormous percentage of the poor youngsters who were the focus of these programs are said to be virtually illiterate" (New Republic. April 18, 1981. p. 21).

- About 85 percent of the youth graduate from high school today compared with about 50 percent thirty years ago.

- The National Assessment of Educational Progress found among those 17 years old that 8 percent of the whites and 42 percent of the blacks were functionally illiterate.

- SAT scores changed between 1963 and 1980 as follows:

  median verbal scores fell from 478 to 424

  math scores fell from 502 to 466.

- Assuming that the intellectual, business, and political leaders come from the more gifted students, we note with alarm that there has been a serious decline in high school seniors who score above 650 on SAT:

  in 1972 there were 53,800 or 5.3 percent

  in 1980 there were 29,000 or 2.9 percent.

- The long term trend has been as follows: average scores on a variety of standardized tests rose until the mid 1960's. Since then there has been a decline, except in science.

- Only 15 percent of high school students study a foreign language and only 5 percent do so for more than 2 years.

- High school students today have very little experience in writing essays that involve library research, thought, revision and criticism by competent teachers.

- Neither have they learned the skills of attentive and analytical reading. Good reading is linked with good writing - but the link is weak.

- "We have seen courts require school districts to present a diploma to students who could not meet minimum state standards of literacy, as if it was the diploma itself they needed rather than the learning that the diploma is supposed to signify." (Ravitch. The American Scholar. Summer 1981. 50 :337).

• An unacceptably high percentage of high school graduates lack the skills needed to fill out a job application.

• We are concerned, currently, with the high percentage of unemployment among the young. But the truly alarming problem is that so many lack the skills that will permit them to enter the labor force of a complex technological society. The ditches of America have been dug - and any now needed are dug by machine.

These dismal data may tell us a little about the innate abilities of students and they certainly tell us a great deal about what they (don't) know. But above all, I believe they tell us about the failures of the educational system. To bemoan that fact that many high school graduates cannot write acceptably, and blame them, becomes sheer hypocrisy if good writing is neither demanded nor attempted in the schools.

In any event, we must take the students as they come - genes and all - as they first enter the schools. For the majority of them what they learn in the next 12 years will depend far more on external forces than on whatever their innate abilities may be. Of these external forces, the classroom teachers play the central role. They are the immediate contact that the student has with the educational system and it is they who transmit what the system has to offer according to the established rules and procedures.

Reflections on the Teachers

We may not be able to do anything about the abilities of the students when they enter the schools but we surely can do something about the teachers.

Considering the critical importance of education for the welfare of society, one might imagine that teachers would rank high in public esteem, that they would be outstanding intellectuals, that excellence would be demanded of them, and that they would be well rewarded for performing their essential duties.

None of this seems to be the case. Many teachers are trapped in an unsatisfactory situation beyond their control, they may be subject to more abuse and violence than the members of any profession except the police, increasing numbers of them are seeking psychiatric care, and the more capable are leaving the profession for positions where their abilities are better appreciated and rewarded.

The teaching profession has never been overly attractive to anyone even though in recent years the beginning salaries have been competitive and, in most instances, the pension benefits are superior. For generations it was the only viable alternative to Kinder-Kuche-Kirche for young women and, even then, only a way station to the socially correct K-K-K life style. Its attractiveness for women remains strong today. The percentage of college bound seniors intending to study education in 1979 was 9.5 for females and 3.1 for males (Science Education Databook, page 55). In 1969, women comprised 55 percent of those enrolled in masters and doctoral degree programs in education and by 1976 this had increased to 65 percent (ibid, page 42).

A career in teaching has always had attractions for those men and women who could place idealism over more materialistic rewards. It is these highly dedicated human beings who are so often remembered by former students who go on to become the leaders in community, government, and business as having made a real difference in their young lives. For some teachers the personal rewards are the most important compensation of all.

In the schools today it appears to be increasingly difficult to realize these other rewards. The opportunities for a meaningful relation with students, of being able to bring out the best in them and in one's self, and the feeling of doing an essential task to the best of one's abilities are being reduced by problems of discipline, apathy, violence, drugs, and the lack of a consensus on what should be taught and the acceptable ways of so doing.

Once again, there is no national voice to suggest paths and goals.

And for society as a whole, we find the serious consequence of the situation in the schools today is that it is the least able cohort of college seniors that is planning a career of teaching in the schools. Thus, for the 5 year period 1970-1975, these were the GRE scores for those heading for education and for the five other areas most related to academic subjects

	Verbal		Quantitative	
	Mean	S.D.	Mean	S.D.
Physical Sciences	509	130	644	106
Mathematics	509	136	672	99
Life Sciences	502	119	564	120
Social Sciences	525	121	523	124
Arts & Humanities	540	123	493	118
Education	458	112	451	120

The unweighted mean for verbal scores in the non-education areas is 517 compared with 458 for education. This is discouraging enough but the gap is far greater for quantitative scores where it is 451 for the prospective education students and 579 for the others (Science Education Databook, page 84).

Some of the more specific comparisons lead to even more gloomy conclusions. If we assume that the prospective graduate students in physics took physics in high school and had similar quantitative abilities, we would find that the teachers, as a group, were nearly 2 S.D. lower. Thus, the upper 20 percent of the teachers overlaps the lowest 20 percent of the physical science students. The data show also that the quantitative scores for the upper 16 percent of the education students overlaps the lowest 15 percent of the mathematics students. (These conclusions are only suggestive since precise comparisons are not being made). In a similar way, the education students, some of whom will be teaching humanities, score nearly one S.D. below college students in this area.

Another comparison is of high school seniors planning a career in education with the average scores of all students. The prospective education students average 45 points lower in math and 35 points in the verbal component. Graham Down, of the Council for Basic Education, is reported as saying "the majority of teachers are only marginally competent" and Albert Shanker, president of the American Federation of Teachers holds the opinion, "we have a public which is as well educated or more educated than the teachers" (Newsweek. April 27, 1981, pages 78-79).

Clearly, a career of teaching in the schools is not attracting the best students; it is attracting those with the lowest test scores. This is an important fact to remember when we begin to think of improving the schools.

The Universities and Schools of Education

I believe that it is beyond dispute that much of the blame for what we perceive to be deficiencies of students at the time they graduate from high school can be placed on their teachers. By the same token, much of the blame for what we perceive to be the deficiencies in the teachers can be placed on the universities and schools of education. They select, educate, and train the teachers.

And most of that blame, I believe, will come to rest on the universities - that is where the buck must stop. This is an unusual conclusion, I admit. In fact, I have never heard it expressed or seen it written. The reason is that most of the serious writing of the genre what-is-wrong-with-the-schools is done by university academics who, quite humanly, have a clearer vision for what is wrong with others than what is wrong with themselves.

The basic fact is that fields of knowledge are defined, developed and enlarged almost exclusively by scholars in the universities and institutions of that rank. Advances in basic science are made by scientists, not by amateurs

working in their garages. Great art and literature may be produced in attics, but melding them into organized knowledge is done by the scholars in the universities. Not only are the fields of knowledge added to principally by the universities, but the universities are also the main transmitters of the state-of-the-art information and thought.

In their teaching, the universities have two major roles. First, those who will enter the intellectual life of the nation will serve their apprenticeship in the universities. Second, they train the teachers who will guide the young in their pre-university years. These two roles are parallel, not in conflict, but, most certainly, they are not the same. One of the major problems in the schools stems from the fact that, quite often, these two teaching roles are thought to be identical, with the result that teachers are not educated specifically for what they will be doing. The university curriculum should provide teachers with a core of general education of the highest quality, rigorous education in the field(s) that they may teach in the schools and, of great importance, suggestions for those aspects and levels of the subjects that are most appropriate for children in the primary and secondary schools.

Digression on Topics and Levels

The last requirement is the one most frequently neglected, or not even accepted, because there is little or no consensus on what topics and levels are most appropriate for different ages of students. My purpose will be, not only to illustrate the process one goes through in arriving at course content, but also to suggest an approach universities need to take in educating future teachers. All too often, a subject presented in the high schools is no more than a dilute version of what the high school teacher studied at the university level. In contrast, we should seek to establish what is possible and appropriate for students to study at each grade level. Unless this is done, there may be need-

less repetition. This, in turn is a tragic waste of valuable time and a procedure that may lead to excessive boredom - especially of the more gifted students. The emphasis here is on needless repetition. When properly controlled, repetition is a powerful and necessary educational device.

In some fields, a fine example is mathematics, the problems of sequence are well in hand.

When we seek to determine the appropriate topics and levels, we must base our standards on what the better students can accomplish. They must be challenged and the less able stretched.

The following example will show what is intended. It involves my own field, biology, but the problem is general. Some years ago the Biological Sciences Curriculum Study produced three sorts of books for the tenth-grade high school biology student. Since most of those determining content and method were university scientists, and since the work began when "pure" scientific research was socially desirable and politically stimulated (with money), these books were very modern and very pure. Since they were produced as a national effort and at federal expense, not surprisingly they rapidly became models for other books. Had this been true solely for the high school level one might have applauded. In a very short time, however, it was discouraging to note their influence being felt at higher and lower levels. The same topics were often developed in almost the same manner, even to the point of using the same illustrations, in books designed for the university students. Sometimes the university books attempted higher level, sometimes not. Almost as quickly much of the tenth-grade biology began to filter down to the junior high school courses, though usually with shorter words and shorter sentences. Repetition is desirable but some of the precious time available for the study of biology was squandered by needless repetition. It would be desirable to treat some of the basic concepts of biology at

several levels but at each higher level there should come different data and deeper insights.

Thus the first major task might be for some group to provide models of biology courses appropriate for all levels from the elementary schools through the first-year university course. The audience should be the general student, not the incipient scientist.

I look upon biology as being concerned with three overlapping levels of inquiry:

1. What is it?
2. How does it work?
3. What is its relation to the present condition and future prospects of human beings?

The elementary years should be concerned more with 1 and less with 2 and 3. Correspondingly the dose and sophistication of 2 and 3 should increase in the biology of later years.

Elementary Biology

The most appropriate sort of biology for the very young is found in the general area that was formerly known as natural history. Surely an elementary student should be able to achieve these goals:

1. Learn the main groups of living organisms to the extent of being able to identify, usually to Class and always to Phylum, the ones most likely to be encountered. One might anticipate that this skill would result in the student being more aware of nature and, with increased awareness, there would come more enjoyment of and more concern for the natural world.
2. Understand in a very general way the main problems of living as an animal and living as a green plant and the interrelations and interdependence of all living creatures. The utter dependence of human beings on plants,

other animals, and microorganisms for food and other resources should be dealt with in a preliminary fashion.

3. Understand that human beings are not totally unique but, biologically speaking, are members of the animal kingdom; acquire an elementary understanding of bodily structure and function.
4. Understand that life on earth has had a long history and that life in the past was different from though ancestral to, life today (but not learn details of evolutionary theory).
5. Understand in a very general way the relation of other organisms to health; the sorts of organisms that provide adequate nutrition; the importance of being careful and clean to avoid organisms that can be harmful.
6. Recognize that there is variability in our species and, it is hoped, accept that fact.
7. Begin the development of responsible attitudes toward other people, familiar animals - especially pets - and all other living creatures. There could start here an attitude that could develop into a true reverence for life.

High School Biology

By the time a student returns to biology in high school, his or her increased maturity will allow the topics to be presented at a higher conceptual level and more in relation to human problems. The high school course is, in several ways, the most critical of any, since it is taken by most students and is the last opportunity many have to study biology. For many it will be their only science.

Thus I suggest that high school biology become more practical: It should be biology related to the problems of human life. It should be mainly human biology. There should be considerable emphasis on the structure and physiology of the human body, including a fairly sophisticated consideration of health

and disease. There should be much on the basic biology of nutrition.

The mere mention of topics of this sort is likely to send those biologists with long memories into shock - they remember the days when a large proportion of biology consisted mainly of "healthful living" and the like, banefully considered. But surely these topics can be developed in as scientifically pure and rigorous a manner as one could desire. There is no need to downgrade the basic biological concepts that are the core of modern biology, but there may be considerable merit in developing these concepts with examples relating to human existence.

The objectives of a high school biology course should be to provide an adequate scientific background, or knowing how to obtain the accurate information, for students to deal with problems of this type:

1. Should I support a proposal for the fluoridation of our municipal water supplies?
2. What are the main trade-offs that I must consider when my community has the chance of attracting a new industry (and we need jobs and an increased tax base) but it is probable that this industry will increase pollution?
3. What are some of the things that I must consider when the physician suggests an antibiotic for my sick child?
4. Do I know how to obtain reliable information on food, drugs, health, and disease?
5. How can I deal with the problem raised by some religious groups who demand that, if evolution is taught in the schools, equal time must be given to religious accounts of creation?
6. Do I fully understand that all is not possible because the scientifically determined laws of nature may result in serious restrictions to individual and social behavior?
7. Do I have sufficient understanding of the history of the scientific enter-

prise and its procedures to understand its strengths and limitations? Do I fully understand that most goals and decisions for myself and for society are not and cannot be based solely on science, but that once a decision has been made, the procedures of science may be powerful adjuncts in reaching the goal? Here, again, we must recognize the fundamental interrelation of what scientists do and what humanists do. In a science course it is easy to overemphasize the importance of scientists and to give short schrift to other ways of knowing and doing. The astonishing progress in science and technology should not blind us to the fact that these enterprises are incapable of answering, or even posing, the more important human questions. The questions themselves and the acceptable answers must always remain the province of the humanities. Science and technology may provide powerful mechanisms for reaching humanistic goals, and for evaluating the consequences of different scenarios, but the choice of paths and goals cannot be theirs.

College Biology

A nonprofessional college biology course should be considered part of a student's liberal education. As such it should lead to a deeper understanding of man's place in nature and of the discipline that is basic to the Age of Science in which we are said to be living. If the course is to achieve these ends, it must neglect the enormous detail that is characteristic of so many first-year biology courses and deal with biology in its most conceptual and relevant aspects.

Whereas the emphasis of elementary biology might be on the surrounding world of life, of high school biology on self, the emphasis of collegiate biology might be on society.

Since the leadership of society comes in large measure from the college trained individuals, the collegiate course should be of critical importance. Society cannot function adequately today, and will be able to function less adequately in the future, if its leaders in government and business lack a

good understanding of science. Some of our serious problems are related to a widespread ignorance of science among our leaders. To be sure, ignorance of, and antipathy towards, science is cultivated by many individuals. There is a feeling, or an escape, in the point of view that somehow science will debase one's humanity. No doubt a world without a soul would be a dead world but, quite possibly a soul without a brain would be equally dead. Indeed it is a little macabre to observe widespread rejection of science when, more than ever before, it has the power to enhance our humanity.

So thoughtful an observer as Gunther Stent has suggested that most of the major questions of biological science now have satisfying answers. The answers are often based upon detailed and highly sophisticated observations and arguments, but the general conclusions are understandable by anyone with the ability and motivation to be in college. Thus, one can know that the physical basis of inheritance is DNA without knowing the intricacies of its moleculor behavior. That powerful bit of information demolishes for all time many of the errors and misinformation about why we are what we are that have part of our intellectual baggage since the dawn of history. In a similar manner, we can view the diversity of living creatures as a consequence of Darwinian Evolution without having to master the mathematics of modern population biology.

Beyond this understanding of conceptual biology one might settle for these few general objectives:

1. One should be led to feelings of belonging to, and participating in, the living world that are based on a deep understanding of the things and processes of that world. It is possible, then, that one would come to have a feeling of warmth, awe, and humility toward the world in which we live.
2. One should be able to deal with the sorts of social questions listed before with greater knowledge, assurance, and courage.
3. There should be a full understanding of the basic fact that no species can

consume forever its essential nonrenewable resources or consume its renewable resources at a rate greater than they are regenerated. Infinite consumption is not allowable in a finite world.

4. But possibly the most desirable end to be achieved would be an ability to deal with the biologically based problems of mankind in terms of long-term advantages, not immediate tradeoffs. In some instances this would involve making decisions that might result in a lifetime of inconvenience in order to achieve a lasting benefit for the human endeavor.

Surely this calls for a new sort of biology and new sorts of leaders. And, surely again, both will be difficult to obtain. But what are the alternatives?

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This long diversion illustrated, I hope, the need for carefully planning the hierarchical sequence of topics so that children will study what is appropriate for their state of maturity and so that unnecessary redundancy will be reduced.

Those university students aiming for a career in education would take the courses intended for the general education of all and, following these, they should be specifically trained to handle the material to be covered in the grades they plan to teach.

There is a problem even more serious than this one of level and redundancy. There is a widespread feeling among educators and the public alike that higher education is failing to meet the needs of the students and the needs of the the country. If this is so, and I believe that it is, our problem becomes critical and awesome.

MAINLY ABOUT SOLUTIONS

At this point I shall switch from the easy procedure of criticism to the far more difficult task of proposing remedial action. Here my suggestions will be guided by my tenth premise - in education we are failing where it is

imperative that we succeed. Reforming education is the single most important long range task facing the United States.

So there will now follow a series of proposals: some merely stated, some elaborated in a paragraph, and some demanding many pages. They vary, also, in the magnitude of the problem they seek to redress. Few are novel; most are obvious.

Only the Student Can Learn

Learning is something that one does for oneself not something that is absorbed passively. The point must be emphasized continually, to students and parents, that education comes only to those with receptive minds and a dedication to the difficult and lonely task of learning.

This basic point needs to be stressed in a society that permits the school boards to be sued if, in the parents' opinion, their children are not learning enough. Apparently the fact that most of the children in the same classes may be learning satisfactorily is no argument. There seems to be a belief that the schools can pour education into young minds no matter how tightly closed they may be.

Learning Requires a Supportive Environment

The quality and quantity of what the child learns will be greatly influenced by the nature of the schools, by the home environment, by the immediate world of the child, and by society at large. Deficiencies in any one of these primary influences will decrease what the child can learn. Deficiencies in any one can be remedied only partially by improvements in the others.

A generation ago some educational leaders seemed to be saying that the schools could (should) do the task almost alone. Many parents were only too happy to agree. Subsequent events have shown how wrong all were. Helping the child to learn is everybody's business.

We Need a National Council on Education

There is a serious lack of leadership in education - from the national to the local level. It is especially serious at the national level and, if we can do something about that, effective leadership at the state, district, and local levels will be made easier.

For many of the things that have been said so far, it must be obvious that only national leadership can bring about the hoped for changes. Education simply cannot be left to laissez-faire floundering at the local level. Too much is at stake.

The achieving of a national consensus and a national direction may be the sine qua non for the reform of education in America. There needs to be some group, let us call it the National Council on Education (NCE), to

- remind society constantly that a fine educational establishment is necessary for fine learning;
- press for a return to excellence and dedication at all levels and in all parts of the educational establishment;
- produce models of what can be taught, from elementary school through the university; models that will maximize the educational experience and reduce needless repetition. There is so much to learn and so little time that efficient coverage is a requirement. If the models prove to be effective school boards and parents groups might push for their adoption;
- insist that the textbooks used in the schools must reflect the best thinking of scholars in the field (allowing for the student's level of maturity). Textbooks must move to that mode from the present one of being the residue of what the publishers release after responding to all pressure groups. NCE might have as one of its important functions the careful reviewing of textbooks and passing its opinions on to school

administrators and teachers.

- encourage the scholars in the universities to see beyond their specialties and their laboratories to the problems of general education and to be willing to join with colleagues in the schools of education to work toward excellence in the substance of education; in short to seek to make education as respectable a commitment as scholarly research and publishing;
- encourage the schools of education to admit only the better students, to graduate only the best, and in cooperation with the university departments, to seek the appropriate education for the teachers-to-be; to insist that entrance to the teaching programs, at all levels, be on the basis of merit and that this requirement remain throughout the teacher's career. The teaching profession cannot be a refuge for the unfit;
- resist pressures that will compromise the educational mission of the schools and universities in the hope of achieving non-educational ends such as automatically passing non-achieving students to higher grades, irrespective of how socially or humanly important these ends might be.
- Try in all possible ways to emphasize to students that learning is important to them and to their country and that they must assist one another to reach the highest possible level of achievement.

In short, the National Council on Education should set the standards for excellence in education and press for their fulfillment in order that the nation can be assured a cadre of highly trained individuals who will become the leaders, a greater number who will enter the professions, and a still greater number who will be informed and responsible citizens.

How might such national leadership for educational excellence be achieved? I am most assuredly not talking about a revamped Department of Education or a new agency of government. We live in shrill and contentious times and there is

little likelihood that the federal government would have the stomach to undertake such a mission or the guts to carry it through.

Instead, I am relying on the possibility that there exists an effective fraction in the educational establishment and society that would be willing to attempt the revamping of education in America. We have been without leadership in education so long, that possibly we are ready to try to achieve something that is necessary for the welfare of the nation, for the future of education itself, and that would give great personal satisfaction.

The key to it all would be to enlist, as members of NCE, individuals who would be of the highest intellectual calibre, have great effectiveness in dealing with governments and people, deep knowledge of the educational establishment, courage, commitment and great charisma. There are such people.

We should also seek the cooperation of existing organizations that are dedicated to studying and evaluating the educational effort. I would suggest that the time has come for these organizations to stop determining what is wrong and seek to set it right. The National Academy of Sciences, National Academy of Engineering, The Rockfeller Foundation, American Association for the Advancement of Science, Carnegie Foundation for the Advancement of Teaching, American Council of Learned Societies, and similar organizations might find among their human and financial resources a nucleus to start such a project. It is hard to think of a more important task for them. At the same time, it would be imperative not to include all the groups that have presided over the decline of American Education and that may be incapable or unwilling to work for meaningful reform. There are such groups.

The suggestion that the National Academy of Sciences, for example, concern itself with education is not new. The Editors of Nature write (30 April 1981, page 723) that "the Academy has been much less concerned with the machinery by which the scientific enterprise is sustained" and lists as the first item of

this machinery, "the education of students in the schools and colleges." At the end of the list the Editors suggest, "the Academy in Washington should move quickly to take up these and a host of related questions".

NCE should begin by having its own committees work closely with a few select universities, colleges, schools of education, state boards of education, and school districts. The goal would be to offer, after careful testing and revision, model plans, examples of excellent curricula, and blue prints for implementation. To the extent that pilot testing of these produced the desired results, NCE should encourage their widespread adoption. This encouragement should not stop with teachers and school administrators, but extend to parents, civic leaders, and the public through TV programs and other devices to inform them of the problems and the proposed solutions.

The drastic reforms that I believe are necessary will not come easily. Accepted philosophies of education will have to change, incompetence will have to be replaced by competence, and a huge amount of dedication, time and effort will be required. Those attempting such reforms will be subject to much abuse. Too many have too much at stake in the status quo. It is almost always more comfortable not to do something than do it. But if we truly believe that education is terribly important, and that presently it is woefully inadequate, the reforms must be carried out. I suggest that it be done by those in the educational establishment plus concerned citizens. Are there alternatives? Nothing in the future of education is inevitable. Everything depends on a national sense of purpose.

Possibly the crisis is of such magnitude that the academic community should temporarily set aside its standard response to a clarion call:

Whether in weal or whether in woe,
The status we always choose is quo

and get on with the job.

Now let us turn to some more modest proposals.

COLLEGES AND UNIVERSITIES

Strengthening University Entrance Requirements

The colleges and universities should raise their entrance requirements. This will require great courage on the part of many of them since the standard response to the declining pool of students seeking admission is to lower the barriers.

Even before the demographic dip, entrance requirements were being drastically reduced in many institutions. The consequences for the colleges and universities has been serious enough but for the high schools they have been disastrous. What the high schools do, to a large degree, is what the universities demand. If the universities demand disciplined students with first-rate achievement in high school mathematics, history, writing, sciences, foreign languages, and the social sciences, the high schools will produce such students. Once again the fault lies not with the students but with what is demanded of them.

The declining pool of high school students need not result in a reduced educational mission in the colleges and universities. The crying need in America today is for more and better educated people. Two very large opportunities would be the extensive reeducation of teachers and of individuals in mid life who need additional education for their positions and for their personal lives. The reeducation of these more mature students might be found to be exceptionally appealing to the universities.

Higher Education's Standards Must Be Raised

The colleges and universities should raise their own standards. The disruptions of the '60s and '70s, the danse macabre climate of our times, the uncertainty about societal goals, plus the influx of inadequately educated students, have been followed by a drastic decline in what is demanded of uni-

versity students. Grade inflation is a well-recognized phenomenon, accepted as bad but inevitable. It will be exceedingly difficult to return to what were once accepted standards. But return we must since so many of today's graduates are insufficiently prepared to take their places in society and to make it work.

The return to acceptable standards will be all the more difficult since the new faculty entering the universities were, themselves, trained in lax times. Some seem unaware of the meaning and importance of excellence - regarding it as little more than outdated bourgeoise fuddyduddiness.

There is, happily, some current evidence of a change in attitude by students and professors. Students appear to be more motivated to appreciate that education is important, and the profs find it possible to demand more. That a change seems in the wind suggests that more drastic reforms would be possible, practical, and acceptable.

But if the universities demand that the students coming to them from the schools be better prepared, it will be easier to demand from university students what they must do. Once again, reform in the universities is essential before there can be overall and sustainable reform in the preuniversity schools.

Reforming the Undergraduate Curriculum

This long section will deal with a difficult problem - reforming the undergraduate curriculum. For more than a generation, faculty members have enjoyed almost anarchical freedom, and in some disciplines at least, the reward system has supported this situation. One was rewarded for doing the best for one's self rather than for one's university. Many university presidents became seekers of funds rather than leaders in education. It will be exceedingly difficult to change this comfortable professorial life. We have yet to ascertain the effects on science teaching in the universities of the huge influx of

research dollars. These dollars gave us the greatest research establishment in the world but I have yet to hear anyone say that these dollars vastly improved the teaching done by the researchers. The professors in the unrewarded disciplines must have felt like second class academics.

The pressures for leveling down were severe during the campus disruptions of the 1960's. Standards and requirements vanished in an effort to placate the students. Goals were deflated, and grades were inflated. The convenient myth was accepted that the students knew what was best for them. "The results should surprise no one. Most students, it turns out, do not favor imposing course requirements on each other. They do not favor examinations, low grades, or restrictions on freewheeling curricular options. Many faculty members find it convenient to share these views, for when laissez-faire becomes the guiding philosophy of education, life is even more comfortable for teachers than for students" (Stephen M. Cahn in The New Republic. April 18, 1981, page 19).

The existing model for lackadaisical higher education in the United States has probably run its course but completing its demise will be as torturous as in a Wagnerian opera. Neither society, students, nor faculty are satisfied with what is now being done. There is little evidence of mission, excitement, vision, or style. Instead, there are malaise, lethargy, and a feeling of being locked into a system that cannot be changed. The major concern seems to be to garner a budget that will allow us to do next year what we are not satisfied doing this year. Higher education seems to have lost nerve and verve.

So, the first point that I want to make is that we should start with great plans and with great expectations. By doing so, we will end with a better product than if we do the safe thing and plan with small minds and with modest expectations. Here "safe" might be the most dangerous thing we could do.

The pressures of the times are forcing us -and should force us- to reevaluate our curricular goals and procedures. Our goal should be for universities

to do their tasks with such distinction that they would be recognized again as vital, forefront institutions of society, and so be cherished and nourished. These are some of the notable pressures, many discussed earlier, that will help to force change:

A. The days of ever-increasing numbers of students and ever-increasing budgets are over for the foreseeable future at least. The largest five-year demographic cohort, consisting of those born in 1957-1961, is almost through the college years. These young people became 18 in 1975-1979 and, hence, represent the maximum pool of university students. The younger cohorts are progressively smaller. This need not mean fewer students if an increasing percentage of those in the relevant cohort enter the universities or, as noted before, more older students return for mid-career refurbishing. The former is not happening; the latter may be. The data on budgets are so familiar that they need not be iterated.

B. As pressures for student admission decline, one can expect a disproportionate effect on the small and less distinguished institutions. When the chances for entering the greater institutions are enhanced, the need to settle for the lesser becomes reduced. The more distinguished universities will maintain their numbers and that will leave poorer pickings for the others. Recent reports in the press indicate that, nationwide, the better students are selecting the private universities and usually those in the northeast.

C. It is generally agreed that the students entering the universities today are less well prepared than those of earlier generations. Scores of nationwide aptitude tests show serious declines and the ability to speak and write clearly is well below acceptable standards. The high schools must not be blamed solely for this situation.

D. No one seems optimistic that the high schools and their graduates will improve rapidly in the near future in spite of the current outcry. In fact,

the trends are viewed as alarming by competent observers. This is a most complex subject and those not well acquainted with the situation in the high schools are unlikely to be aware of the severity of the decline. In many schools, including many that formerly provided good education, meaningful education is now almost impossible. Of equal concern is that some of the "remedial" procedures now being instituted, such as competency tests set at very low levels, are likely to exacerbate the problems.

E. Thus, the task of the universities is becoming more difficult. Their problem will be to deal with poorly-prepared students. At the same time, there is a general feeling in society that the universities must produce better, and more appropriately educated, graduates than they now do.

F. Societal malaise and a lessening of hope among the young (for a good job and a good life) produce a less favorable environment for teaching and learning. For many students, the goal is training, not education.

G. Institutions in general, including those of higher education, are held in low esteem by a discouragingly large percentage of the population.

H. As society increases in size and complexity, there is an ever-increasing need for young people of exceptional talent and education to enter leadership positions and keep the system functioning. Many citizens regard the universities as a sort of Maginot Line - producing products not even well prepared to deal with the past.

Thus, as I read the climate of the times, the conclusion is that the job we are asked to do in higher education is more difficult than ever to accomplish and we will be given fewer resources with which to work. But if one accepts the proposition that nothing less than a fundamental overhaul of higher education in the United States is required we must get on with the job. No one knows what the best education for the 1980's and beyond will prove to be. The reasonable way to proceed, therefore, is by experimentation. Such an experimen-

tal approach can be undertaken more readily in a small institution than in a large one - the possibility of change among similar institutions is inversely related to size. The proposed National Council for Education should seek the cooperation of universities that can become laboratories for investigating new and better ways of educating the young.

Now is the time for change. It is widely believed that education in America has lost its sense of mission and has lowered its standards. The social and political revolutions following World War II saw the questioning of society's previously accepted values. Those values, determined by a small segment of society, became less acceptable to other segments previously excluded as setters of values. Not surprisingly, social status based on sex, birth, or wealth was eschewed. That development, far from harming higher education, should have enhanced it since it would broaden the base of the students entering the universities. Such cannot be said for another pervasive philosophy - the discounting of merit, skill, achievement, intellect, and commitment. Those without talent could discount its virtues. And, in a period of tremendous productivity and prosperity, society could allow a large proportion of its young to "do their thing".

By and large the universities went along. Seemingly any activity - even looking at television - carried academic credit. The curriculum was hit by an egalitarian wildfire. Since it could be demonstrated that little, if any, specific knowledge was essential, it seemed possible to conclude that no knowledge was essential. Not surprisingly, a variant in Gresham's Law went into operation "Bad Education Drives Out Good Education". Courses were downgraded and grades were upgraded. In an individual's curriculum, nothing remained as essential - anything (so long as it was something) was acceptable.

Prolegomenon for a New Curriculum

The universities, in educating the young, have two major roles - doing

something for the individual and doing something for society. These goals are not always congruent, and it becomes the problem of those defining the curriculum to achieve an acceptable balance.

The needs of society are for a constant stream of trained minds; of individuals who are humane, versed in the skills of communication, knowledgeable of international, national, and local affairs, sensitive and appreciative of the diversity of mankind, skillful in balancing trade-offs before reaching a decision, appreciating that man is a social animal and that one's ethics must be based on that fact; who can serve as models for others; who are disciplined and effective people; who recognize that the preservation of society requires a constant attempt to maintain what is good from the past, to improve what exists, and to respond to what is new; to balance society's good with the individual's good; and to hold to a firm belief that it is important to work for a better future.

The university can do little more than play a passive role in this impressive list but it can provide the environment where individuals seek these objectives to the maximum of their abilities. It seems unlikely that the desired results will be the automatic consequences of the pattern of university education that now exists. That pattern has been tried and found wanting. I believe that there are several reasons for this.

1. The students play too passive a role in their own education.
2. The gulf between academe and the forum is dangerously broad.
3. In the courses of study there is an overemphasis on the traditional and an underemphasis on the relevant.
4. There is no assurance that the courses taken by an individual student will be coherent, that they will provide the basis for a broadly conceived education, and that they will be challenging.

In an effort to deal with these and other problems, I suggest that we

undertake two major tasks: introduce a new series of university seminars and produce a new core curriculum.

University Seminars. Every student should enroll in a University Seminar each quarter (or semester). These should have no more than 20 students per section, meet for 2-4 hours each week, and be taught solely by ladder faculty, with an exception to be noted shortly. All ladder faculty should be involved but not every person for every quarter. These seminars should deal with the many important aspects of education that are not dealt with in conventional courses.

A. The continuing theme should be current events and placing them in perspective. The students must read a daily newspaper and/or a weekly news magazine. They must be able to report the important events of the day, to understand the pros and cons of various courses of action, and to express their own well-thought-out opinions. The educational objectives here are not only an understanding of the world of today but on developing the facility of speaking before a group, of writing clearly and succinctly, of dealing with problems that frequently have no clear solutions, of understanding the variety of opinions that may exist, and of becoming tolerant of, and even respectful of, the opinions of others.

B. To the greatest extent possible the students should attend any available plays, concerts, dance programs, art exhibitions, and similar events. These should be discussed in class sessions. This local "entertainment" should be thought of as an essential part of the curriculum - and so supported.

C. Visits to local museums and other cultural institutions should be a recognized part of the curriculum.

D. There should be geological and biological field trips.

E. Once every quarter, each student should prepare a written report

on some topic (book review, something of interest seen in one of the museums, historical or contemporary problems). This report should be given orally and the manuscript duplicated and distributed to all in the section for evaluation.

F. In the junior and senior years, the students should be encouraged to organize their own sections to study in detail some problems of mutual interest and concern. A faculty member should be involved but only as a supportive resource person.

One might explore the usefulness of having the students remain together in the same section for Fall and Spring Quarters of each year (assuming a quarter system) but join new sections during Winter Quarter. Some such device might maximize the combination of developing the skill and coherence of the social group yet allowing for the exposure to new ideas and individuals.

G. In a four-year period each student would participate in 12 University Seminars. It is essential that the students work with a carefully selected sequence of faculty members. Presumably there should be 12 different faculty members but there should be a balanced sampling of those from the humanities, social sciences, and natural sciences.

H. In their senior year, selected students should be given the responsibility of supervising the sessions of first-year students.

I. The possibility should be explored of grouping majors with similar interests in University Seminars to explore the interrelation of their academic specialty and the social, political, and economic forces in the world about them. One should probably restrict these to not more than one quarter of the student's junior year and two quarters of the senior year.

A Core Curriculum - Civilization

It is painfully apparent to those teaching undergraduates today that many

of our students are largely ignorant of both past and present - ignorant of things and events that are traditionally part of an educated person's store of knowledge. So I propose that we institute a new, rigorous, four-year sequence of courses that would have two main objectives.

1. To survey the ever-changing human condition, worldwide, from the early Neolithic to the present.

2. To study, in depth, what the Club of Rome refers to as the problématique humaine, that is, the cluster of problems that will come to crisis stage in the life-span of our present students and that will determine their existence as well as the future of humanity.

The course I have in mind, let us call it Civilization, is to be the core of the university education. It should meet possibly as frequently as five times a week for the four undergraduate years. There should be a laboratory (sensu latum) associated with the course.

I cannot emphasize too strongly that I do not have in mind a resurrection of the Western Civilization courses, of the circa 1930 model, which have only become extinct in recent times. I am talking about an in-depth study of the problems and accomplishments of human beings, worldwide, for the last 10,000 years. Thus, one of the major topics when dealing with the Neolithic would be the nutritional requirements of the human species and how these were partially solved by agriculture. Plant domestication would be discussed in terms of the biological and evolutionary forces that converted wild species, with low and unpredictable yields, into the cultivated strains that, in time, would provide a basis for civilization. Later when cities arose in the Mesopotamian and Nile Valleys, the new problems associated with human beings living in large groups would be introduced (disease, new social organizations, trade, laws, rulers, organized religion, etc.).

Historians would be involved in this part of the course but so would

anthropologists, geographers, biologists, and those trained in comparative religion, agriculture, and the social sciences. In fact, here and throughout the four years, one should include all disciplines that could illuminate the period being discussed. Civilization would require the participation of all disciplines.

When one arrives at the Golden Age of Greece, for example, one would deal not only with the material basis of human life, the economic and social arrangements of the time, but also the art, literature, science, and technology. The Art History faculty should deal with sculpture and architecture; those in literature should accompany the students through a few of the outstanding works of the period (in translation). The philosophers should tell us how their field started and reached a noble height. The scientists and historians of science should start with the eternal problems of science and outline tentative answers. And there must be a consideration of the machines and technological processes associated with that disastrous phrase, "the conquest of nature".

I have said nothing about the laboratory so far. There should be one, offering "hands-on" experience. Its role should not only be the conventional one of allowing students to find answers to questions, but it should help overcome the deadening passiveness of youth in America today. A large part of this is associated with the TV load that our youth carry. By the time they reach the universities they will have averaged 20,000 hours before the tube - more time than they will have spent in school. The schools themselves are passive affairs. Writing, speaking, reading, homework, and laboratory work have all declined in recent years. The young, especially the urban young, live a truly deprived life. Their minds and hands need greater stimulation and opportunities - which a "hands-on" laboratory can provide.

Some of the things that the students in Civilization might do in the "laboratory" are: raise a crop, make a clay pot, smelt some ore, make a bronze

tool, carve a piece of stone, weave cloth, clean a chicken, play a simple musical instrument, study a steam engine, study an internal combustion engine, paint a picture, begin with a view camera and end with a photographic print, study the physics of familiar home appliances and the chemistry of familiar processes, take several geological field trips when studying Lyell, spend evenings studying the stars, visit local mines, farms, utilities, factories, learn simple navigation, make a map, take several biological field trips when talking about Linnaeus, Darwin, and the earlier naturalists, listen to great music and poetry readings, study prints and slides of great art, go to different churches.

This list of things to be done must not stand in isolation. These laboratory projects are to illuminate the topics covered in class.

The time allowed for the various historical periods may work out about as follows:

First year. From the early Neolithic to the beginning of the Industrial Revolution.

Second year. The Industrial Revolution and to the end of the 19th Century.

Third year. The 20th Century to the onset of World War II.

Fourth year. World War II to present.

The second objective of Civilization will be to deal with the problématique humaine. Garrett Hardin, in one of his insightful essays, refers to this as "one of the major tasks of education today". A concatenation of serious problems has descended upon us: depletion of resources; burgeoning populations; environmental pollution; international, intranational, and interracial strife; crime; urbanization; poverty; inflation; stress; illegal immigration; pervasive pessimism; loss of a common code of ethics; and institutional stasis. Can we honestly claim that the universities are providing students with the background to deal with these problems? Yet, surely, they must be dealt with.

These are not isolated problems. They are part of an integrated terror that emerges from the complex interactions of human nature, technology, and the environment.

The problématique humaine must be dealt with by trained, disciplined, and informed minds. The human experiment has produced some successes and many failures. There is abundant evidence of practices that produced short-term gains at the expense of long-term disasters. Plato complained of agricultural practices that were ruining the soil of Attica. He described these and their consequences in a manner befitting a modern enviromentalist. Similar practices converted Rome's granary in North Africa to a near desert. The point to be made is not that these destructive practices have been going on for as long as we know, but that today there is a fundamentally different situation. Civilization did not collapse when the topsoil of Attica washed into the Aegean. It moved on to Rome and westward (it did collapse in Attica, however). One could, and did, move from the despoiled fields to the virgin soils of other regions and other continents. But we can no longer run away. The world is full and we must make do with what we have. There is little evidence, so far, that we are prepared even to try.

Throughout Civilization there must be a detailed treatment of the human activities of the past that have led to the problématique humaine of today. It is hard to think of a more important task for the universities.

Important, yes; sufficient, no. There are two other major areas where a systematic, disciplined, and in-depth study is required: Health and Law.

Health and Law

Health should be a year course, with laboratory, scheduled for the junior year. Private health and public health are basic to all other aspects of life. Surely this is a fit subject for academic study. There is much that one should know, not only because of one's intimate involvement, but also to have the back-

ground necessary for wise social decisions. The delivery of health care has become one of the largest industries in the nation.

The highlights of the history of medicine will have been covered in Civilization. Health should cover the pathology of the main diseases of human beings and the current treatments of choice; basic human anatomy and physiology (to be done in the lab); nutrition, sexuality and birth control; mental health; protection of food and water supplies; the organization and financing of health care; national and international public health problems; the cycle of birth, development, aging, and death; the importance of the home environment in the development of the child.

The associated laboratory work should provide basic information about human anatomy and physiology; a study of local hospitals; food processing plants; public water supplies; waste disposal; local procedures for dealing with air pollution.

Law should also be a full year course, scheduled for the senior year. We are, after all, a social and political species whose civilization would be impossible without laws. Laws are basic to our community life in the same way that health is basic to our personal life. Realizing that, it is remarkable that the universities tend to exclude both from serious treatment in the curriculum.

Some of the topics that might be included in Law are: ethics and the problem of human beings living in groups; the need for, and historical development of, codes of law; law enforcement-- police, penal systems, punishment, the judiciary; the sociology and biology of crime; the basic laws of the land; business law; contracts; regulatory aspects of government; management of conflict; dissent; legal aspects of marriage and other monoecious arrangements; self protection; insurance, estates, wills; IRS, and taxes.

Objectives of the New Curriculum

These four courses: University Seminars, Civilization, Health, and Law would be designed to:

A. Provide a coherent and common education (all four courses) for all students. Education would stand for something that is identifiable, unified, and shared.

B. Provide an understanding of the human experience in all its aspects (mainly in Civilization).

C. Provide an opportunity to develop skills in reading (mainly Civilization), speaking (mainly in University Seminars), writing (mainly in Civilization and University Seminars).

D. Relate university education to the world of today (Civilization, University Seminars, Health, Law).

E. Provide information that will allow one to deal with the cluster of crisis problems that characterize the world today and will become exacerbated in the near future (mainly Civilization).

F. Promote collegiality of students and faculty.

Objections of the New Curriculum

Awesome but manageable. It would be most difficult to introduce such a radical departure from our time-honored way of doing things. But there is reason to try; after all, our time-honored ways are not as honored as they used to be.

Initially many faculty members would have to be persuaded that they should participate. The proposed courses are not what they have experienced as students or do as teachers. Such a departure would necessitate a very large amount of work for those who are already burdened with what they are doing in teaching, research, and university service. To do the new, they would have to abandon some of the old. One must accept that what I am proposing would require a high order of effort and

dedication yet promise only an uncertain result.

Similar objections might be assumed for the students. We are still in a period when many students wonder why they are at the university, cannot see that what goes on is relevant to their lives, have gone through the schools at a time when free choice and lack of rigor are prevelant, and when a desire to understand the human past and present is minimal, and who prefers training for a specific job to a broad general education. They have rejected many of the basic things a university is all about.

There are also problems about the abilities of the existing faculty to provide informed inspiration on all of the topics listed so far. Some new and different minds might be needed (Law, for example).

The adoption of the proposed university curriculum would have profound implications for the existing curriculum. The four courses would satisfy most of the things that we now regard as essential for general education and would occupy about a third of the student's time. Nothing has been said about foreign languages, mathematics, or the major; this comes shortly.

Implementation

Should my proposals form the basis of discussion and eventually of action, I believe the prudent way to proceed would be to begin on a small scale and slowly search and test our way. One would have to enlist a small number of deeply committed faculty members in a few institutions who could see their way clear to spend much of their time at very hard work for the first few years. In a similar manner, one would have to select a small group of students willing to work out the details of a new university education.

If one could assemble the requisite number of dedicated teachers and dedicated students, I cannot see how the experiment could fail. No one could maintain that what was being attempted was unimportant, uninteresting, irrelevant, or not demanding the highest order of scholarship. And we must add

a powerful psychological force: the great enthusiasm of any group striving for a common goal. The Hawthorne Effect would illuminate the early years.

Tentative success would call for increasing the number of faculty members and students to be involved. One might even be allowed to hope that, if well done, the pressures would be for participation. Thus, we would attract the type of student who would profit from the curriculum that is proposed and, that in itself, would increase the chances of success. There might well be a parallel phenomenon to be observed with the faculty.

None of this will be possible without strong leadership. The top administrators must be concerned, involved, and supportive. But above that there must be that strong national voice to reiterate constantly that efforts of this sort are essential. NCE could provide it.

There is no reason to believe that the core curriculum already described would not fulfill the general requirements for a university education. History, philosophy, literature, technology, natural science, social science, and political science should have been dealt with in a coherent and broadening manner. A university education must be more than a core, however, and I turn next to the other components.

Foreign Languages

Never have they been more needed and more neglected. As noted before, only 5 percent of high school students study a foreign language for more than 2 years and 85 percent never study one. Many universities have no foreign language requirements for entrance or departure. If they have one, it is almost never sufficient to provide a useful understanding of the language. Competence in a foreign language is ever less required for graduate work. The nation simply does not have enough individuals fluent in foreign languages who can attend to American interests in the One World in which we live.

The universities could remedy this situation first, by encouraging those

who seek admission to have at least 2 years of a foreign language in high school. It could even be stated that preference would be given to applicants, otherwise acceptable, who had taken more than two years of a foreign language in high school. Second, with such an introduction, students should be encouraged to take at least two more years of the same language in the university.

Writing

Another declining skill. It is generally believed that the ability to write clearly should be a requirement for entrance to the universities. Yet it is not, and ever higher percentages of those coming to even the most prestigious universities are being shunted into remedial classes and bonehead English. Those who are not English professors assume that the English Department should set things right. English professors proclaim their inability to so instruct the young, emphasizing that they are scholars and critics of what has already been written and published, and (sometimes) maintain that they themselves are not all that great at writing. The task is frequently left to the Teaching Assistants, which illustrates the importance we attach to such a vital aspect of education. Programs attempting to help students write clearly and effectively are orphans in most universities.

In a most extraordinary coupling of circumstances, the perceptions of the students and the behavior of professors reinforce the notion that acceptable writing is something that need be done only in English classes. When the formal training in effective writing is supervised by the Teaching Assistants (the least experienced teachers), students often assume that quantity can balance the lack of quality, that writing is concerned more with the emotional outpourings of a warm heart than with the reasonings of the disciplined mind. Few students seem to realize that the sine qua non for effective writing is having something to say.

In the rare event that a science professor would complain about a stu-

dent's poor writing, the student's response is likely to be, "This isn't an English class, is it?" The answer should be "yes". Teachers in all disciplines must insist on clear and effective writing. It is astonishing how little writing is necessary in the university. Objective and completion type examinations relieve the students from the need to construct a complete sentence. Some observers place the major blame for the decline in writing skills on the widespread use of objective examinations that began two generations ago. Term papers are far less frequent today than a generation ago, especially in universities on the quarter rather than semester schedule. The declining skills in effective writing make correcting essay examinations and term papers a painful project. The reluctance of university teachers to demand effective writing is that it is a time consuming chore to read and correct essay examinations and term papers, especially of the illiterati. As a consequence, the reduction or abolition of specific requirements for students has included the requirement for effective writing. When requirements for graduation are being phased out it is surely virtuous not to require something that places such an onerous burden on the profs. Once again, as Cahn noted pages ago, the laissez-faire mode is even more comfortable for teachers than for students.

The existing system is intolerable. The disastrous notion that good writing is necessary only in English classes and that the English Department's Teaching Assistants are to be the principal teachers, must be replaced by the commitment that all academic disciplines be involved. Students would come to recognize the importance of effective writing if the university faculties come to believe it themselves - and demand that it be done. This requirement should be especially important in the student's major. There, presumably, the student has something to say - and it should be said clearly.

One does have to be practical, however. It is unreasonable to expect students in the huge introductory courses to have term papers and essay examinations.

Correcting them would be too difficult. But isn't it reasonable to demand both for classes with fewer than 30 students?

Mathematics

I do not have a well-thought-out position concerning the level of mathematical ability that should be the minimum for general education. Some mathematics would have been included in Civilization, mainly historical aspects.

It does seem reasonable to suggest that when we advise students, especially in the lower grades:

1. We be careful not to convey to girls the notion that their mathematical abilities are modest at best;
2. We do not suggest to students heading for the humanities, males and females, that mathematics is probably beyond them.

Could university mathematics be made more appealing to students if the emphasis switched from mathematics itself to the solution of problems that uniquely depend on mathematics? One thinks of problems associated with: surveying, navigation, business transactions, the statistical evaluation of data, sampling techniques, graphical representation, banking, budgets, projections, and so on. Respectable mathematics can be employed for these topics.

The Major

It is generally agreed that the universities do a better job of education in the major fields than they do in general education. The student sees the courses in the major as basic to the hoped-for career. What is good is received with gratitude and what is not can be tolerated. When students in the 1960's were demanding more relevance in education, "relevance" meant knowledge in relation to mankind today and the use of that knowledge in solving human problems. Now that the Weism of the 1960's has been replaced by the Meism of today, relevance means preparation for a job. If we can't save mankind, at least I can save myself.

On this vast topic of education in the major field, I offer only a few thoughts for consideration:

A. Education today is so wasteful of human time and demanding of society's resources that we should seek ways of doing the same, or even a better job of educating, in less time. The junior high schools, the senior high schools, and the universities have so reduced their demands and lowered their expectations for students that a general increase in rigor could see far more education for the same expenditure of time and dollars. Young people then would be far better prepared for a career when they leave the university. Alternatively, we could reduce the time devoted to education. But that would be a truly inferior alternative. Producing the results we complain about today in less time is hardly the answer to the nation's needs.

B. Would it be useful to think of more structured general education requirements for those students aiming for the postgraduate professional schools? It is especially important that these students be broadly educated, considering the positions they will occupy in society. They tend to be the better students. For these two reasons, possibly we should demand more of them.

C. Some university departments set such heavy requirements for their own courses and those in cognate areas that a broad undergraduate education is almost impossible. Such demands are generally excused as being necessary for graduate work in the field. Could some of this course work be postponed to the graduate years?

There is a problem here, however. There has been a general decline in formal graduate course work since World War II. The older goal of broadly training graduate students has been replaced by a system that locks them to the laboratory bench (or the equivalent in the non-sciences) and lets them loose only to attend the specialized seminars in their own field. This might be an efficient way to train the highly skilled specialist, who will soon be

at the cutting edge of his discipline, but I wonder how effective this system is for educating those who, in addition to their research, will also be university teachers or even be able to keep up with their ever-changing speciality.

Understanding and Information

A university course should strive to give understanding as well as information. This more important problem relates to most university courses, not merely those in the major. Many are sadly deficient in this regard. The information explosion that has occurred in all fields has been estimated to involve a doubling of facts and concepts every 10-15 years (de Solla Price Little Science Big Science). Not only has the quantity of information increased so rapidly, but so has the elegance and economy of the explanatory hypotheses. Many teachers respond to this avalanche of facts by stuffing as many as possible into their courses. A more useful philosophy would be for the university course to provide the intellectual antecedents for the subject under investigation and a conceptual framework that will help the students arrange the facts in an understandable whole. The goal should be to develop minds, not to stuff them. Another questionable development is the frequent goal of being absolutely up to date. That in moderation is fine and important in stimulating the students' interest but if being up to date means learning about only those discoveries of the past few years, such breathless modernity is of questionable value. The grand design of the fields of knowledge is not of recent origin.

Let me give an example. In a course just concluded and populated almost entirely by senior biology majors, two questions were raised in a discussion. The first was what was some of the evidence that convinced geneticists that genes were parts of chromosomes. The second was what was some of the evidence that has led biologists to the notion of organic evolution. In a class of 23, not one student could give an answer to either question. In the course where they might have learned about the physical basis of inheritance, they had been

told that genes were on chromosomes and then had gone on to the structure of DNA. In the course where they might have encountered the evidences for evolution, the students had been given evolution as a fact and then gone on to study the Hardy-Weinberg formula and population genetics.

I wonder (of course I don't) if one should be educating the biology professors-to-be in such a way that they will not know the evidential basis for some of the most fundamental concepts in their science. This shattering experience led me to ask friends in other universities if their students would be better informed. The answer, so far, is "no".

And this brings us to an equally serious and related problem.

We need to look beyond the name of a course to its content. When faculties set about to introduce new courses or to reform the curriculum, there is rarely any meaningful consideration of what the course or requirement is intended to accomplish. Where there are breadth requirements, it is customary to include a course in science. But has a faculty discharged its duty merely by requiring a year of (any) science? Should there be some concern with the substance and mode of presentation? If the faculty as a whole legislates the requirement, should not the faculty as a whole have something to say about how the course is given - and by whom?

I believe, very strongly, that in this Age of Science all students in the university should be required to take at least a one-year course in science. But rarely is a course in science adequate to meet the needs of general students, that is to provide understanding of the nature of science and its strengths and limitations. Introductory courses in science tend to be overloaded with details, to ignore the basic substance of the field for "the latest", and to be regarded by the department as serving mainly to provide the vocabulary for more advanced work in the major. The vast majority of students who will not go on will have

served their time, learned a vocabulary that they will never use, and felt the time poorly spent.

Last week I asked a respected colleague in the humanities why he and other humanists supported a science requirement when he knew such courses fulfilled none of the high hopes he might hold for it. "Because we know if we did not support the science requirement, the scientists would not support the require-ments in the humanities - and we are no closer to meeting your expectations."

Is this one of the (sour) fruits of academic freedom? Can we do no more than ask our colleagues to teach what seems eminently worthwhile but then stand aloof if they do not do so satisfactorily? Once again we meet the laissez-faire mode. Without a constant input of energy, the Second Law works out its inexor-able consequences for the curriculum as it does for everything else. There was a time when most presidents and deans were leaders in education. They had a vision of what was right and by constant encouragement and pressure sought to realize that educational vision. In recent decades, the responsibility for the curriculum has shifted to the faculty and the individual professor. Now that the shift has occurred, we find a lesser sense of commitment and responsibility. The problems of education are rarely considered in a more substantial manner than to list the names of those courses that are required for graduation - and there are not too many of them these days.

Courses for the Non-Major

Aficionados of General Education sometimes request that a university department offer an introductory course especially designed for non-majors - the future lawyers, legistators, businessmen, journalists, preachers, and housepersons. The basis for such a request is that the standard introductory course is too specialized, too technical, too hard, or otherwise "not appro-priate", for other than majors. Almost always these non-major courses are in the sciences. Physics for poets, historians, philosophers, and art majors is

accepted. Poetry, or history, or philosophy, or art for physicists is not. So the breadth requirement for graduation as a humanities student for a year of natural science can be met by this special sort of course, which most admit is a device to "get the students through."

If science is thought necessary for a university degree and the student likely to take only a single course, a strong effort should be made to offer a truly first-rate course. The special sorts of things that are thought to characterize science - its rigor, verifiability, analytical methods, and ability to predict - should be stressed. It should introduce the major concepts of the specific field being taught: once again, understanding should be at least as important as information. How do scientists think? How do they make discoveries? What are the strengths and limitations of their methods? How do the statements of science compare with those in philosophy, religion, or the humanities in general? What are the problems of controlling science and technology? What are the natural laws that human beings will disobey at their peril? What are the social responsibilities of science and scientists? Is science our master or servant?

How often do non-major science courses do a distinguished job of educating this very special group of students - a group that should be made to feel at home with science and not fear it as a field or as a course? Not very often, I suspect. The non-major science course is all too often approached with dread and found to be bland and intellectually unsatisfying. Not infrequently, once a faculty lists a natural science course as a breadth requirement, there is a rush to include as "science" things that are not. In this devious effort, the goal is to find a way to avoid the requirement, not to fulfill it.

There must be a better way-- and I believe there is. I would argue that the sort of science that would be respectable, intellectually satisfying, and important for the non-major is the sort of course that would be even more appro-

priate for the major. The unsatisfactory solution of having non-major science courses should be replaced by first-rate introductory courses for all.

Once again, we need some respected national voice to remind those in the universities that it is terribly important that we think deeply about what education should accomplish and then devise ways of so doing. The reward system in the universities has paid slight heed to the educational mission in recent years. We cannot wait much longer for the universities to discover that the nation's future depends on their sending into society a constant flow of superbly educated young women and men.

This, also, will be a very difficult task. A concern with education is not always fashionable among faculty members of the leading universities. It would probably be a lethal behavior pattern for any aspiring non-tenured assistant professor. There is even evidence in some fields that the list of published research, long the criterion for advancement, is now being replaced by the list of grants. (In one respect an improvement. One does not have the difficult quality-quantity problem with grants as one does with published papers. Quality and quantity are equal for grants.)

A summary of the argument about the state of education in the universities would emphasize these main points: The reduction in standards - what is required of students and faculty members and what is expected of them - has resulted in a serious impairment of the educational mission of the university. For the most part, universities lack adequate educational leadership, they spend little time in a search for better methods and vehicles of instruction and learning, and the commitment to graduate only well-educated students has almost vanished. Even the centers of excellence have shared in this general decline. Much of the blame, I believe, must be borne by faculty members. The brighter side of freedom is responsibility - and those who champion academic freedom should be equally ardent champions of academic responsibility. Maybe

these things need to be said.

So much for the general education mission of the university. Now we shall turn to the schools of education.

SCHOOLS OF EDUCATION

Cooperation with University Departments

The schools of education share with the university departments the responsibility of educating and training the students who will become teachers in the schools. To be effective this partnership must involve a close and sympathetic working relationship. Such is almost never the case. The university caste system reaches its silliest height (depth) in attitude toward the schools of education. The "regular" faculty member is all too likely to view with disdain all pre-university education ("never learn anything"), all undergraduates who express a desire to become teachers in the schools ("the real dregs"), the sorts of courses taught in the schools of education ("Mickey-Mouse"), and the people who teach them ("could never make it in a regular university department").

This attitude of contempt is, itself, contemptible. The education of those who will become teachers in the schools is as difficult as it is important. It can be effective only if there is close cooperation of all those responsible. We are not satisfied with the calibre and the training of those entering the teaching profession. A fair share of this failure must be borne by the university departments. It usually falls to them to set the standards of scholarship and provide the education in the discipline, especially for teachers in the higher grades.

The task for the university departments is to provide those aspiring to be teachers with education in depth as well as special education. The education in depth should be accomplished by the regular departmental offerings, especially if they stress the conceptual as well as the factual. The special education should deal with the specific aspects of the field that are appropriate for the

grade level that is to be taught in the schools.

Another task for the university departments, which will be mentioned shortly, involves the updating of the teachers' education.

Standards Must Be Raised

And there are things that the schools of education must do. They must insist on excellence when they hire, retain, and promote faculty members. One could argue that those who teach the teachers should be the most learned and the most gifted in the university. This is not generally perceived to be so.

The schools of education must upgrade their admission standards. They are still admitting those university students in the lowest quartile of SAT. That practice is unlikely to give us a superior cadre of teachers in the schools.

For unfortunate reasons, this may be the time to switch to admitting only the most gifted students. The need for new teachers has reached a low point and, except for a few fields, the job prospects will continue to be poor for some years. A lead article in the L. A. Times of 20 May 1981 carried the headline, "1 of 3 Teachers in U.S. to Get Layoff Warning. 100,000 May Actually Lose Jobs". That dreary prediction suggests that the schools of education will not be called upon, in the near future, to turn out large quantities of students - so they should concentrate on quality. Not only should the schools of education raise their admission standards, but they should seek to improve what is offered to their students and what is demanded of them.

It will be as inadmissible for schools of education, as it is for colleges and universities, to admit marginal and submarginal students solely to maintain existing levels of operation. There should be no need to start closing the doors of universities and schools of education. When one thinks of the enormous task of retraining the teachers now in the schools, expansion rather than contraction might be necessary.

The general perception in higher education is that the schools of education do have lower standards for what they do, what they teach, and whom they teach. To the extent that this is true, it is totally unacceptable. The answer is not for the rest of the university to berate the schools of education but for all to work cooperatively and effectively to seek ways to produce fine teachers for the schools.

Some of these points are emphasized in the 18 May 1981 The Chronicle of Higher Education. The deans of education at Stanford and Ohio State suggest that "schools of education may well become extinct if they fail to improve the quality of the training they provide"; "brighter students are no longer attracted to them"; "school districts are having a great deal of trouble finding teachers with intellectual orientations"; "student achievement is associated with the verbal S.A.T. scores of the teachers so, if people with low scores enter the profession, their students are sure to suffer academically"; and the sad fact today is that "the average verbal S.A.T. score of students going into teacher education is below 400 --the second lowest score among all groups of college majors (the lowest is ethnic studies)". A later issue of The Chronicle (September 23, 1981) reported that the School of Education at Berkeley has fallen to such a low level that its survival is in serious doubt.

Once again, only an analysis of the problem. But what is to be done? It seems unlikely that any substantial improvement will "just happen".

TEACHERS AND THE SCHOOLS

We Need Better School Teachers

If we are really serious about education, we must have far better teachers in the schools. The universities and the schools of education must educate and send into the profession only the best. The job market today offers opportunities for very few teachers (except in science and math) so only the truly gifted should be accepted as students.

It is one thing to accept only the best; it is another matter to keep the best in the schools. One problem is the state of the school environment - many young teachers may not be able to endure the stress and violence of life in some schools. Another is keeping those remaining informed and effective in their fields. The pressures on school teachers are frequently such that it is impossible for them to find time or opportunity to keep up to date in their speciality. This is an area in which the university departments could serve still another important role. America is largely urban today, hence, most school children will go to school in or near a city. Nearly every city has a college or university of some sort. Thus, these institutions could offer, as part of their regular responsibility, special courses for the teachers. Again, these should not be "let me tell you the latest", but courses designed to update the teachers on what is appropriate and relevant for what they must teach. And, hopefully, these courses would be given not by the Teaching Assistants but by the more experienced and effective university teachers - who will have made an effort to learn what is done in the schools. Earlier it was suggested that the university departments offer special courses for the teachers-to-be appropriate for their future work. These courses and the refresher courses might be the same or at least have considerable overlap. If the same, one could imagine that the experienced teachers could contribute much to those anticipating entering the profession. As part of the teacher's professional obligation, and continuance of employment, refresher courses might be required every 5 years.

But what do we do about the large number of existing teachers who have secure positions and who are probably inadequate for the task of reforming education? Here we have the choice of doing something for the individual or reforming education. Again, if we are really serious about the critical national need for vastly improving the educational establishment, I cannot see how we can do it without retraining or replacing the inadequate teachers. In some instances

retraining might bring the very poor to marginal acceptability but many would surely have to go. There is no alternative. In education, what is best for the student and the nation must come before all else.

This, clearly, is not a very edible bullet and it is nearly impossible to imagine an agency of government willingly biting it. An agency couldn't even talk publicly about the problem. The suggestions and guidance would have to come from some respected, non-governmental group. If the problems were presented honestly and humanely, the necessary reforms would surely have strong public support. Americans, by and large, are tremendously interested in education and aware of its worth. They constantly fail to vote for school bonds, not because they are against education, but because they believe the schools are doing, on the whole, such a miserable job.

We will have to think very carefully about the current suggestions for competency examinations for teachers. We should also think about the resistance of the powerful teachers' unions to using merit as a basis of promotion. Is the system designed to protect the individual teacher, with or without competence, or is it designed to promote the best in education?

The April 27, 1981 issue of Newsweek brings some serious charges against the teachers in the schools. After quoting Graham Down of the Council for Basic Education as saying that the majority of teachers are only marginally competent, the article cites the case of one considerably below that level. A school board sought to discharge a teacher who by general agreement-- even her own ("I don't think I did more harm than anyone else")-- was not able to teach her classes adequately. She was discharged, the case went to court, and the judge ordered her rehired. The reason given was "that her dismissal notice contained a misspelled word, that the principal used faulty grammar... and the policy manual had 77 grammatical errors in the first 82 pages". Justice for whom? There is a serious question whether or not, with judicial opinions of

that sort, there can be meaningful reform in the schools. There can be no reform so long as the general good is sacrificed to the individual good.

The Environment for Learning Must Improve

The school environment must be such that learning and teaching are possible if able teachers are to be attracted. Apart from those with a fulminating martyr complex, it will be exceedingly difficult to persuade all those badly needed, bright, humane, talented young people to undertake a career of teaching in the schools. The ones we should like to employ may have seen too many updatings of the Blackboard Jungle sort of program on TV. They read things such as the three-issue essay in Newsweek (April 20, 27, May 4, 1981) or the April 18, 1981 The New Republic - all devoted to education. They will have gone through the schools very recently and many will have emerged with very negative opinions. Teaching in the schools is not an attractive prospect - the environment in many schools is conducive neither to teaching nor to learning.

Yet the most optimistic fact of all is that there are some first-rate schools and many first-rate teachers. They all are far too few to serve the requirements of the nation, but numerous enough to suggest the dimensions excellence. There is even general agreement on what constitutes a fine school. Dorothy Wickenden puts it this way:

> "The common denominator of successful schools, whether they are independent or public, inner-city or surburban, is unconditional insistence upon high standards - in the teachers they hire, in the curricula they choose, and in the students they educate, slow and fast learners alike. The public school principals in DC and other urban areas who have gotten out of the office and into the halls and classrooms, who have actively sought parental involvement in their child's education, and the teachers who have stubbornly refused to compromise their expectations have seen the same gratifying

results as their counterparts in private schools: motivated, enthusiastic students who understand why they are in school" (The New Republic. April 18, 1981. page 14).

Ronald Edmonds of the Harvard Graduate School of Education lists five characteristics of effective schools (Newsweek. May 4, 1981. page 66):

1. Principals who are active leaders.
2. An orderly climate.
3. Emphasis on basic skills
4. Standardized tests to measure those skills.
5. Teachers with high expectations for all students.

Now follow some thoughts on ways of improving the school environment which, to the extent it can be achieved, will make a career in teaching more attractive to the talented young people we must attract.

Homogeneity Of The Students In A Class.

Not homogeneity of race, creed, or culture but homogeneity in terms of the students being disciplined, intellectually and emotionally capable of performing at the level desired, and capable of being motivated to learn. Students must have high expectations for themselves and for their peers. Students not possessing these characteristics should not be allowed to have a deleterious influence on those who do. This point of view may not be in vogue currently, but haven't we gone too far in our concern for those students at the lower end of the scale and in our neglect for those at the upper end? All students must receive attention - even those who are more likely to achieve the most for themselves and for their country. Equity should not always mean leveling down.

Discipline

The classroom teacher must be able to enforce discipline and, in so doing, must have the strong backing of the school administration and the parents.

Today the penalty for the disruptive student is usually feeble or non-existent - reflecting the dying liberal hope that basically we are all good and any fall from that state is an unimportant and transitory anomaly, preferably to be ignored. Penalties should be sufficient to encourage compliance by the student or, indirectly, by the parent(s). If they are not effective, expelling the unruly will allow the remaining students to function in a better climate. The notion here is that the schools are for education, not for the incarceration of those who, for whatever reason, are unable or unwilling to learn. Alternative ways must be sought to help these other young people, in the expectation that many will eventually return to the regular classrooms.

Intellectual Homogeneity

The problem of intellectual homogeneity should be evaluated in relation to the advantage of homogeneity vs the advantages of diversity and the criterion for choosing a solution should be the educational gain. If lumping the high achievers and low achievers inhibits the educational progress of the former and adds to the frustration of the latter, the choice should be obvious. If our goal is to add to the nation's pool of highly educated individuals, and if it is clear that exceptional students develop more rapidly and more fully when with their peers, let's so group them. The education of the best students should not be sacrificed for the benefit of the marginal. Here the problem of the courts reappears: in the District of Columbia grouping by ability has been banned because it is thought to be racially discriminatory.

Nor is it necessary that the admitted advantage of students coming to grips with diversity ("the real world") be denied. There can be some classes or situations where there could be a mixing, especially in those situations where the normally low achievers do well. There is some evidence that some can excel at laboratory work, for example. (Or, not being serious, I might suggest sports: the Egg Heads vs the Block Heads. And I know where I would

put my bets!)

Motivation

Since learning is such a personal affair, motivation is of the utmost importance. Those who wish to learn should not be held back by those who do not. Some motivation can be innately generated but so much depends on encouragement by the teachers, by family, by fellow students, and by the societal climate of the moment and what is predicted for the future.

Learning is a very difficult task and becoming evermore so as the complexities of society and what is demanded of the young both become greater. So those who earnestly seek education must be nurtured with all deliberate care.

Yet, there is much evidence that motivation, itself, can be acquired. Thus, the unmotivated should not be treated as lost souls but should receive special help in an effort to remove the block to motivation. This would not help all— some students live such desperate lives that there is little that a friendly teacher or school counselor could do.

Achievement for Promotion

Promotion from one grade to another should be solely on the basis of achievement. This, in itself, would greatly ease the burden of teaching and so make a career in the schools more attractive. A tenth grade teacher having students with reading abilities that range from the third to the twelfth grade level must find life terribly frustrating. And one can imagine the problems for those students who happen to fall at the two ends of the distribution. The origin of this unbelievable practice is said to be the pressures of some social scientists who held it more important (socially) for the students to remain with their peers, lest their psyches would be damaged. Such a point of view can legitimately be held only by those who do not believe that education is the primary mission of the schools. So long as automatic passing is

in vogue, only the least perceptive teachers and students would not reach this conclusion: education doesn't really matter.

Schools should return to the rigorous standard of requiring achievement at grade level before the student is passed to the next higher grade. Thus, the incredible practice of requiring 8th grade competence for graduation from high school, and all similar downgrading of requirements, should be prohibited. The student should remain in the 8th grade until competence in that level has been achieved.

The discounting of American education has reached the state where Paul Gagnon (French historian, Univ. Mass) recently said that "all French adolescents, not just the select few, receive an education by the age 15 or 16 that is the equivalent of what the American student covers by the end of the sophomore year in college". Surely an overstatement but, to the extent that it is true, we would seem to be wasting about 3-4 years of our young people's lives and the many billions of dollars required by the school system to harbor them for those (educationally) useless years.

If achievement at grade level were required, the classes would be considerably more homogeneous. At least those students promoted to the 9th grade would have achieved at least 8th grade competence. I should hope that this sort of ability-grouping would not be banned by the courts.

Prune and Revise the School Curriculum

The curriculum should be pruned and what remains should be extensively revised. The time has come when we must take education in the schools seriously. In the past few decades we have been excessively discourteous to the school curriculum. What was basic, respectable, rigorous, and necessary for education has been diluted with a pot pourri of courses that borders on the anti-intellectual: marriage simulation, cheerleading, astrology, student government, death education, values education, student leadership, yearbook,

school paper.

Restoring educational quality requires returning the curriculum to the almost complete emphasis on respectable math, science, writing, English, history, social sciences, political sciences, foreign languages, and the arts. In spite of what we are told so often, some subjects are more important than others: history is more important than black history; literature is more important than women writers; chemistry is more important than energy education; biology more important than death education; physics is more important than astrology. (We may have a problem in the conversion: the teacher of astrology might not be a satisfactory teacher of physics.)

A great deal of the teachers' time and the school budget could be saved by eliminating some of the "timely" courses that have burst upon us since World War II. Possibly we are beginning to understand that the timeless is the timely. Not that we teach 1920's biology, for example, but the biology we do teach is to be appropriate and up-to-date.

The basic courses should be reevaluated to decide the appropriate topics and appropriate level for the various grades. This is part of the quest for reducing the redundancy that is so wasteful in education.

Strengthen Graduation Requirement

Requirements for graduation from high school should be broadened and the required level of competence raised. We should require 12th grade competence, if one is to receive a high school diploma, in reading, writing, and mathematical computations. The graduating student should have performed satisfactorily in a spectrum of courses that will allow for effective participation in society. High school education should provide an effective introduction to the exciting world of the adult - to read a book for pleasure or attend a concert, to visit an art gallery with understanding, be able to participate as a citizen in matters of national, state,and local import; be able to view the natural world

and civilization with appreciation and understanding. A high school diploma should certify a level of attainment that will permit one's education, really just begun, to continue throughout life.

This may not sound much like the average American high school graduate and I would most certainly agree. Yet other nations are reported to do far better in 12 years of schooling than we can manage. Once again, this is not the fault of the students but of the permissive and standardless world in which they have grown.

Monitoring Progress

There must be realistic monitoring of the schools and students. There is little likelihood of effective reform of the American educational system unless we have reliable, on-going measure of competence, effectiveness, and improvement. Evaluating schools and students is now a growth industry but we tend to measure poorly and then to hide those results that seem inconvenient. There is a tendency to set standards at unrealistically low levels and to withhold the scores if it is suspected they might offend the sensibilities of special groups or communities. For example, the eighth grade competency level required for graduation after the twelfth grade of high school in California is readily achieved by eighth grade students and, when given to students in even lower grades, many of them pass as well. On some of the examinations used nationwide, the achievement levels are adjusted as the performance of the students declines.

For many of the widely used examinations, information about the relative performance of local schools is regarded as Top Secret. Parents remain ignorant of how well their children are being served by the local schools. This practice of withholding such information will certainly reduce the flak the teachers and administrators of some schools will receive but it is not such information needed for remedial action?

Equally unfortunate are those decisions noted earlier, to adjust (down naturally) the level of the competency examinations to the "realities of the local situation."

I cannot see what useful purpose is served if students and parents are led to believe that an acceptable level of achievement has been reached when, in fact, it has not. Students are in school to prepare themselves for a useful life in society and, if this has not been achieved, there is no virtue in pretending that it has.

So, we must have accurate, up-to-date, publically-available, information about the performance of students and schools. There will never be a time when all students and schools are the same. The best goal we can hope for is that the range of students in all schools will be much the same. That is, we must ensure than no school prevents a student from developing to the limit of his abilities. That goal cannot be achieved without information.

Parental and Public Involvement

Parental and public participation should be encouraged to the greatest possible extent. If we accept that education is a societal phenomenon, not something restricted to the schools, society should be intimately involved in what the schools do. Parents, especially, should be strongly encouraged to participate. These are some of the usual sorts of things that parents can do: tutoring, helping the mites with their galoshes, supervising study halls, reading stories, helping the handicapped, assisting in the library and lunch room, and so on. Ideally much more should be involved. There should be special programs to show parents how they can help with their children's education in the home. Seminars, short classes, and brochures could get across the point that, for the child's total education, it is vital that the home environment be supportive. At home the child must see books, newspapers, and good magazines and hear and be involved in conversations

about important matters. If possible there could be joint parent-child learning experiences - all the better if they supplement or even depart entirely from what is being done in the schools. Where public television is available it can be excellent as are some of the programs on commercial TV. My purpose here is to reiterate the point that education is everywhere -- it is not just a 9:00 - 3:00 event that occurs behind those four brick walls.

And there is a dark reason for parental participation. In many schools the problems of drugs, violence, alcohol, and vandalism make education essentially impossible. If one were to ask parents, strong ones, to monitor the corridors, toilets, stairwells, locker rooms and play grounds, the crime level should drop. If not, the experience would produce enough irate, frustrated and concerned parents to see that the police did the job.

Parents with children in school represent the obvious group to ask for help but one need not stop with them. Any adults with time and motivation could be involved, especially if they brought special skills that could be integrated into existing school programs.

The Principal

Watching over the school environment and interacting with the parents and public, is the principal. The correlation between tough effective principals and good schools is so strong that one suspects that the former is essential for the latter. Good principals have been able to turn waste-land schools of the inner cities into exciting and safe places where students can learn and teachers can teach. The successful principals stand for excellence, optimism, discipline, hard work, homework, respect, and cooperation. They are leaders with a vision of what good education can be and the strength of mind and character to see that it is achieved. Their own faith in the students and teachers can inspire self-confidence in both. Fine principals understand that excellence in others has not only an innate component but that it can be demanded. And they demand it.

All these good things that are so often lacking in schools today could happen and must happen. But they will not "just happen". If they are to come about, we must first make the demand and then undertake the heavy obligation of participating fully and willingly. If good education is what the nation requires for its children, then we must fix our sights on it. Suggestions for programs and procedures should be evaluated by the single criterion: is the proposal likely to improve education; if not forget it. Today we are asking the schools to do so many other things that education becomes a subsidiary order of business. If the solving of non-educational social problems is set as the primary goal of the schools, the educational mission will be adversely compromised.

IMPLEMENTATION

The possibility of there occurring spontaneous across-the-board and across-the-land changes of the sort I have been suggesting is as likely as having all the nations of the world suddenly declaring peace. The educational system has degenerated to such an extent that only heroic means, sustained for a long time, will return it to the state required for the welfare of the nation.

It is even doubtful that many share my despair or would accept my remedies. Consider these two recent reports from the Office of the President, each produced by a huge staff and a galaxy of notables.

The President's Commission that produced A National Agenda for the Eighties (Government Printing Office, 1980) devoted about four percent of its pages to education. I find it hard to think of any useful agenda for the Eighties unless we do something about the educational establishment. To be sure "The Commission believes that public schools are failing in significant ways to provide the quality of education demanded by the American public" (page 83). Or, "Continued failure by the schools to perform their traditional role ade-

quately, together with a failure to respond to the emerging needs of the 1980s, may have disastrous consequences for this nation" (page 84). If the Commission really believed that, one might have expected it to propose remedial actions. What is the agenda for education for the eighties? One looks in vain for any substantive recommendation. One of the members of the Commission, Benjamin L. Hooks, felt this lack and some of his remarks are in an appendix: "Instead of offering remedies to these problems, the Report contains vaguely worded calls for such things as 'a new spirit of collaboration' or 'learning in community settings outside the schools.' Education is too important to dismiss with such platitudes." (pages 139-140). Right on, Mr. Hooks.

There certainly was no national voice to guide the nation in solving the problems of education in this Report.

But at least they mentioned education. In a more awesome report (766 large pages vs 214 small pages), The Global 2000 Report to the President (Government Printing Office, 1980), education does not even make the index.

Who is thinking about education in the future? "One in five adult Americans cannot read well enough to understand a classified advertisement or the instructions on a frozen TV dinner" (Los Angeles Times, May 23, 1981). What, for example can be the shape of "full employment" if, as the National Assessment of Educational Progress reported, 8 percent of the 17 year old whites and 42 percent of the blacks are functionally illiterate? Possibly we should think about the future of education. That is, if we want a future.

I am suggesting that a National Council on Education be established to think about the future of education. I see no practical way for NCE to start except by issuing exhortations, undertaking experiments in a small way, and then, to the degree that success is achieved, expanding the programs.

One could begin by selecting a few volunteering universities, schools of

education, and school districts that would agree that educational reform is imperative and be willing to expend their human and other resources in the experiment. The key, as always, would be strong and effective leadership, beginning with NCE. The presidents of the universities, the deans of the schools of education, and the local school leadership would have to have the wisdom, vision, power and autonomy for effective leadership. The individual schools chosen would have to possess outstanding principals - those few men and women of principle who are doing such wonders in a few of the nation's schools.

There would be problems, of course, of obtaining the concentrations of truly outstanding teachers to see the experiments through. Possibly the selected school districts would be able to transfer enough of their better teachers to the experimental schools.

By now many readers will be asking, "But where will the money come from?" I think we have it. There are numerous organizations scattered throughout the land that are concerned, totally or in part, with education. Some of these were mentioned before. Currently their funds are expended in documenting the decline and fall of American education. But haven't we had enough of that? Hasn't the point been made? Remedy, not reiteration, is required. If all of these organizations would pool their funds, there would be ample for the NCE sort of thing. One would have to be careful, however, not to allow those organizations that are part of the problem to control the quest for solutions.

In addition, the educational establishment is not poor (in funding). I have never been able to understand why, if vast sums of money are given to institutions that then do an unsatisfactory job, they have to be bribed to do a better job.

The amount spent on education in the United States is enormous. Edith Green has recently estimated it to be about 200 billion a year (for comparison, the total national defence budget for 1979 was 118 billion). The total enroll-

ment from kindergarten through graduate school in 1979 was 58 million, or 26 percent of all inhabitants of the United States. The cost per student, therefore, was $3448. That same year the cost of education represented 8 percent of the GNP. In 1979 the per capita disposable income was $8728 or 2.5 times the cost of educating a student. Again, by way of comparison, the total budget of the United States in 1960 was 92 billion, less than half the education bill today.

In its formative years, NCE's most important function would be to say, again and again, what are the goals, what has to be done, and what are some of the ways it could be done. This might be seen as an unimportant function were it not for the fact that there is no respected national voice saying these things. Those institutions and individuals that could make notable contributions to educational reform are unorganized and there are no agreed-upon goals.

Some of the things that must be said have been scattered through this long document. In summary, here are some of them.

THIS WE MUST SAY

We must say, that for the individual,

- education is the greatest gift that society has to offer and the greatest responsibility the individual can assume
- to the extent that education is denied or inadequate, the individual is to that degree denigrated and society to that degree impoverished.

We must say, that for the nation,

- education is the basis of life, health, and happiness
- education is one of society's foremost duties
- the direction and substance of civilization come from the nation's educated elite
- our prosperity and standing in the world depend on the educated excellence of our leaders in government, business, the professions,

and the institutions of education and on a well-educated citizenry.

We must say that, for the educational establishment as a whole,

- drastic reform is sorely needed
- we must achieve a national consensus on what must be done, a willingness to search for viable solutions, and a readiness to mobilize the resources needed to carry them out.
- reform must take a holistic approach. Tinkering with the parts has already proved ineffectual
- it must be accepted that education is the primary mission and that the solving of non-educational social problems within our educational institutions can be undertaken only if they clearly contribute to education
- the prevailing permissiveness and lack of standards must be replaced by rigorous disciplined education
- excellence is what it is all about, so the effort expended on an individual student should reflect to some degree the probable attainments of that student.

We must say to the universities that,

- they are the central element in the educational structure and, hence, must be the origin of reform
- education is, after all, the central mission of the university, even of the largest research-oriented universities
- they must raise their entrance standards, demanding a higher level of competence for the high school graduates entering their gates
- they must demand more of their students and their teaching staffs
- the undergraduate curriculum must be extensively revised so that the general education of the students will prepare them for life in today's society while continuing to provide excellent specialist education

- there must be a renewed emphasis on the core subjects of general education
- they serve their students well when they convey understanding as well as information
- they must cooperate with the schools of education to provide suitable education for those students planning a career of teaching in the schools and for courses that will keep the practicing teachers up to date.

We must say to the schools of education that,

- they must stop accepting as students the least able of the college graduates and accept only those of ability and strong motivation
- they must enforce rigorous standards for themselves and for their students
- they can permit only able students to graduate and enter the teaching profession

We must say to the schools that,

- the time has come to insist on quality education
- there must be renewed concern for ensuring that students are competent in the basic skills of reading, writing, and mathematics
- promotion from one grade to another shall be based on achievement, not the aging process
- decisions should be made on the basis of what will contribute to improved education
- there must be renewed emphasis on those subjects that, over the years, have been recognized as most important for education
- courses should reflect what is appropriate for the age level and, by careful planning, avoid needless repetition of the same material
- they should work out cooperative ventures with parents and public,

recognizing that education involves the totality of society

- the quality of the teaching corps must be improved
- strong principals must be sought and supported.

And we must say to one another that,

- we can no longer afford the luxury of complaining about the schools and doing nothing
- we must insure that schools rid themselves of violence, drugs, and dregs and become places where teaching and learning can be effective.
- we cannot insist that the schools be given social problems to solve that we, as a society, have been unable to solve
- we must recognize the home as a place where essential education occurs
- we cannot allow the schools to be pressured into teaching narrow sectarian views. If we ask that a subject be taught, the details must be left to the scholars and authorities in that field
- schools are unlikely to be able to enforce discipline and demand acceptable behavior by the young if we do not insist on it in other social settings
- we will settle for nothing short of the best education, for all, that the brains and the resources of the nation can provide
- most of all we mean business.

Acknowledgements

An earlier draft of this paper was read and constructively criticized by my fellow members of the Commission on Science Education, especially by our Executive Director William C. Kelly, and M.L. Rosenthal, Walter Deal, Sally Gall, Betty Moore, Don E. Meyer, William V. Mayer, William Thomson, Tim Lynch, and Ruth Cooper. I am indebted to them for interest and support.

ABOUT THE AUTHOR

John A. Moore — biologist, teacher, writer, observer of the educational process, citizen — was born in Charles Town, West Virginia, in 1915. He attended elementary schools in Markham and in Hume, both in Virginia, and secondary schools in Hume, Washington, DC, and New York City. He received bachelor's, master's, and doctoral degrees in zoology from Columbia University, the last of these in 1940.

Dr. Moore advanced through the professorial ranks at Brooklyn College, Queens College, Barnard College, and Columbia University before joining the faculty of the University of California at Riverside in 1969. He is currently professor of biology there.

He has conducted research and written widely in zoology and evolutionary biology. He was elected to the National Academy of Sciences in 1963 for his contributions to those fields.

Dr. Moore's writings in the fields of science, education, international aspects of science, and public science policy are almost as numerous as his research papers. He has been an active member or officer of many committees — both national and international — in these areas and currently serves as a member of the Commission on Human Resources of the National Research Council.

Especially germane to his authorship of the present paper is Dr. Moore's participation in the course-content movement beginning in the late 1950's. He was Chairman of the Committee on the Content of the Curriculum during the planning stages of the Biological Sciences Curriculum Study (BSCS) in 1959-60. This led to his being named supervisor of the "Yellow Version" program of the BSCS from 1960-1976. The resulting "Yellow Version" textbooks, entitled Biological Science: An Inquiry Into Life (Harcourt, Brace and World, 1963), led to a virtual revolution in the teaching of high-school biology in this country and abroad. Concerning this contribution, William V. Mayer, BSCS

director, has written:

> "On the basis of this one activity alone, Dr. Moore has probably influenced more students around the globe in their attitudes toward content and methodology of biological science than any single individual who has ever lived."

It should be added that, measured by the numbers of adoptions, use, and degree of interest stirred, this textbook was arguably the most successful of BSCS versions, which were probably the most widely used of the science curriculum projects. Dr. Moore points out that he was not alone in this project, that hundreds of teachers, fellow scientists, and others participated with him. However, he provided the critically needed leadership.

He has also been involved in efforts to improve science teaching in the elementary schools and colleges. He served as a member or chairman of the Commission on Science Education of the American Association for the Advancement of Science during 1967-1972 when the AAAS science course for elementary-school pupils was being developed and tested. His interest in undergraduate science has been present throughout his professional career, surfacing at the national level from time to time, for example, by his service on the NRC Committee on Undergraduate Curricula in the Biological Sciences in the late 1950's. He is a practitioner, not a theorist: his classroom teaching load has always been heavy.

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